

# Pediatric mTBI (concussion) CDC guidelines OCTOBER 23, 2019

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# Disclosures

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No financial interest

Some discussion of off-label medications

Shameless photos of cute kids



# Objectives

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Be able to describe prognostic factors in mild traumatic brain injury (formerly known as concussion).

Be able to discuss various methods for evaluating mild traumatic brain injury, including radiologic, serum, and neuropsychological studies.

Be able to describe instances when escalation of care is appropriate in mild traumatic brain injury.

# Demographics

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- Pediatric head injuries annually account for
  - 500,000 ED visits
  - 95,000 hospital admissions
  - 29,000 permanent disabilities
  - 7,000 deaths
- Can be caused by
  - Sports
  - MVC
  - Falls
  - Projectiles



# CDC Guideline on the Diagnosis and Management of mTBI Among Children

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JAMA Pediatrics, 2018

Lumba-Brown et al

Review of articles published from 1990-2015

Public commentary 2017

# Recommendations

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Sorted by Level of Confidence  
and Strength of  
Recommendation

Level of Confidence:  
- High

- Moderate

- Low

- Very Low

Strength of Recommendation	
Level A	Should almost always be followed
Level B	Usually should be followed
Level C	May sometimes be followed
Level U	Insufficient evidence to make a recommendation
Level R	Should not be done outside of research setting

# What is a mTBI?

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The condition formerly known as concussion

“An acute brain injury from mechanical energy to the head from external physical forces including 1 or more of the following:

- confusion/disorientation
- LOC 30 minutes or less
- PTA less than 24 hours
- other transient neurologic signs

PLUS GCS of 13-15 after 30 minutes post-injury or later upon presentation for healthcare”

# BRAIN INJURY CLASSIFICATION:

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- Quick note: ED GCS tends to be more reliable and more helpful in recovery prediction than GCS in the field

- Mild: GCS 13-15

- Complicated Mild: GCS 13-15

**PLUS ANY ACUTE INTRACRANIAL INJURY (SDH, Fracture, etc)**

- Moderate: GCS 9-12

- Severe: GCS 3-8



# Symptoms of mTBI

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Loss of Consciousness

Confusion

Mental Slowness

Headache

Dizziness

Visual Disturbance

Sensitivity to light/noise

Somnolence

Vomiting

Repetitive Speech

Amnesia of event

Memory Impairment

Ataxia

Abnormal Affect

# How is it diagnosed?

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- mTBI is a \*clinical\* diagnosis
- Physical examination may be normal
- There are additional diagnostic tools, but there is no single “test” for mTBI or concussion

# History:

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- Timing (when did it occur)
- Mechanism (fall, assault, MVC, sports, trauma,...)
- Location (frontal, occipital,...)
- Associated symptoms (LOC, seizure, vision changes, personality, etc)
- ED GCS (if available)
- Imaging (if available)

# Role of imaging in mTBI

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**KEY QUESTION:** Is it going to change your management?

# CT imaging

AAP Guidelines (1999)

PECARN (2009)

CDC Guidelines (2018)- Moderate level of Confidence, Level B

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Why should we think carefully about doing a CT-head on a child?

- It increases the lifetime risk of intracranial neoplasm.
- **WORTH ASKING:** Does your local CT scan have the ability to adjust radiation dosing for kids?
- Resource/cost utilization
- False positives
- Looking for possible ICI



# PECARN Head Injury Study

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- **Pediatric Emergency Care Applied Research Network**
  - *Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study*
  - Lancet 2009, 374:1160-70
- Identified children who **really, really don't** need CT scans

# PECARN Head Injury Study

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- “Severe Mechanism”
  - MVC with ejection, rollover, or death
  - Ped/bike vs car without helmet
  - Fall
    - > 5 ft (> 2 yrs)
    - > 3 ft (< 2 yrs)
  - Impact with high-velocity projectile
- “Mild Mechanism”
  - Fall from standing height
  - Running into stationary objects
- “Moderate Mechanism”
  - Anything else

# PECARN Head Injury Study

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## AGE <2 years

- No LOC or LOC < 5s
- Normal mental status
- No scalp hematoma or frontal only
- Non-severe mechanism
- No palpable skull fracture
- Acting normally per parents

< 0.02% risk of ciTBI

## Age 2 years+

- No LOC
- Normal mental status
- No vomiting
- Non-severe mechanism
- No sign of basilar skull fracture
- No severe headache

< 0.05% risk of ciTBI



# MRI

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## MRI:

- Not modality of choice for acute evaluation (Moderate, Level B)
  - Need for sedation
  - Length of study
  - Expense of exam
- Rapid sequence MRI is changing this somewhat, as a large amount of data can be obtained quickly on non-sedated patients (evolving area)

# Other advanced imaging

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SPECT (single-photo emission CT):

- Not useful in acute mTBI (Moderate, Level B)
  - Need for sedation
  - Contrast
  - Expense of exam
- Could consider in more chronic cases, but need clearly defined question

# Skull radiographs

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**NOT** appropriate in setting of mTBI

- Fractures or intracranial bleeds may not be visible with this modality

HIGH level of confidence, Level B strength of recommendation

# Other acute assessments

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## Serum biomarkers

- Not recommended outside the research setting
- High level of confidence, Level R

## Computerized assessments and symptom scales

- Age appropriate symptom scale is recommended (CDC website has standardized form we use in clinic, 22 symptoms in 4 categories)
  - Moderate level of confidence, Level B
- Age appropriate computerized cognitive testing may be helpful (example: ImPACT testing is used in clinic) and may help distinguish between presence or absence of mTBI if baseline measures available.
  - Moderate of confidence, Level C

# Knowledge check

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Why should we wear helmets when riding a bike?

- A. They prevent concussions.
- B. They prevent skull fractures.
- C. We don't need them. Doctors actually get a kick-back every time a helmet is sold, which is why we recommend them.

# Why do we care about skull fracture prevention?

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- Complicated mild brain injury (mild brain injury in presence of acute intracranial injury) recovers along the lines of a moderate brain injury from long-term cognitive perspective
- Skull fracture is automatic side-lining from any contact sport for at least 8 weeks while the skull heals
- Clearly, skull fracture can be devastating, particularly if displaced

# Prognosis

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**- 70-80 percent of pediatric mTBI will not show significant related problems beyond 1-3 months from injury (Moderate, Level B)**

- Each child follows his or her own path to recovery, and there is no single factor or finding that can predict symptom resolution or outcome (Moderate, Level B)

# Delayed recovery

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Delayed recovery may be more likely in children with comorbid lower cognitive ability, neurologic or psychiatric disorder, learning disorder, family or social stressors, or prior TBI. It is recommended that providers obtain a detailed past history (including social) to guide counseling on prognosis (Moderate, Level B)

- Persistent post-traumatic symptoms occur more often in older children/adolescents, Hispanic population, lower socioeconomic status, or those with more severe initial clinical presentation.
- Girls more likely than boys to have persistent headaches



# Past Medical/Surgical History

## Developmental History

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Prior concussions (How many? Mechanism? How long did it take to recover?)

ADHD

Learning disorder

Headaches

Pain disorder

Sleep disorder

# Tracking recovery

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- Use standardized tool
  - CDC has excellent 22 point symptom scale/tool that is sensitive to change and can be followed over time (Moderate, Level B)
  - Reaction time (Moderate, Level C)
  - Balance testing (Moderate, Level C)

# Symptom checklist

Physical (10)	Cognitive (4)	Emotional (4)	Sleep (4)
Headache	Feeling foggy	Irritability	Drowsiness
Nausea	Feeling slowed down	Sadness	Sleeping less than usual
Vomiting	Difficulty concentrating	More emotional	Sleeping more than usual
Balance problems	Difficulty remembering	Nervousness	Trouble falling asleep
Dizziness			
Vision problems			
Fatigue			
Sensitivity to light			
Sensitivity to noise			
Numbness/tingling			

Worse with  
Physical activity?  
Cognitive activity?

# Management of mTBI

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- Rest but not too much
  - Physical
  - **Mental**
  - Sleep
  - More than a few days of strict rest can be harmful (Moderate, Level B)
- Gradual resumption of prior activity through a graded resumption of physical and cognitive activities BUT not increasing activity level until symptom free (Moderate, Level B)
- Consider a progressive rehabilitation program to work up to improved tolerance of activity (High, Level B)
- NSAIDS or Tylenol for pain – NO NARCOTICS!!! (Moderate, Level B)

# Graded return to play

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## Graded return:

- Low: walking, light jogging, stationary bike
- Moderate: jogging, sprinting, lifting, throwing
- Heavy (non-contact): drills
- Full contact practice
- Full contact games
  
- Progress no faster than 1 day per step!!!

# Should my kid play sports again?

## AAP Classification of Sports by Contact

Contact or Collision	Limited Contact	Noncontact
Basketball	Baseball	Archery
Boxing (not recommended by AAP)	Bicycling	Badminton
Diving	Cheerleading	Body building/lifting
Field hockey	Canoeing/kayaking	Bowling
Football (tackle)	Fencing	Crew/rowing
Ice hockey (checking to <15 yo)	Field events (high jump, pole vault)	Curling
Lacrosse	Floor hockey	Dancing
Martial arts	Football (flag)	Track and Field events
Rodeo	Gymnastics	Orienteering
Rugby	Skate/snowboarding	<u>Riflery</u>
Ski jumping	Skating	Running, Race walking
Soccer	Skiing	Jump rope
Team handball	Softball	Sailing
Water polo	Squash	Scuba
Wrestling	Ultimate <u>frisbee</u>	Swimming
	Volleyball	Tennis (and table tennis)
	Windsurfing or surfing	

# Academic restrictions

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School attendance (consider after a few days)

- Consider a middle ground (half days)
- Increase gradually

Homework:

- Limit at first (none, then 30 minutes, etc)
- Extra time to make it up, eliminating unnecessary work

Testing:

- Not recommended in the recovery phase
- ImPACT testing can be helpful here

# Academics

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At school:

- Allow rest periods for headache
- Allow preferential seating
- Dark glasses
- Hydration at the desk
- Pay attention to screen time

Prolonged symptoms: Consider 504 plan (High, Level B)

- Parents must request in writing

- may need neuropsych (High, Level C)



# Activity recommendations

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After initial period of rest (24-48 hours optimal), work towards *increasing* physical activity

Response to increased activity varies depending on pre-morbid activity level

- If very active previously, tend to do better with increased activity
- If not active, need to go slowly with return to activity. May need to use PT as a proxy, if indicated.



# Long term Outcomes

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**80% recover in 2-12 weeks without significant long-term problems**



## Personality

- Recovery can take a long time
- Frontal disinhibition

## Grades

- Generally stable with supports during recovery
- Can fail without proper support

# When to consider additional testing

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Rule of thumb: If testing may change your management (medically, academically, athletically)

If not getting better, **there's something else going on...**

- MRI
- Neuropsych testing
- Lab
- Sleep study
- Psychosocial issues



# Headaches

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Address contributing factors

- PT to work on cervical postural retraining
- PT for ocular retraining (call around to find the best places)
- Hydration status
- Rebound headaches

If strong enough, try medication

- Scheduled NSAIDS, then wean off
- Elavil, Topamax, Propranolol
- If migraine suspected, follow migraine protocol



# Headache CDC recommendations

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- When accompanied by worsening neurologic symptoms, acute headaches should have emergent neuroimaging (High, Level B).
- Hypertonic 3% saline should not be administered outside of research setting for treatment of acute headaches (Moderate, Level R).
- Offer non-opioid analgesic options (Moderate, Level B)
- Chronic headaches are often multi-factorial and require multidisciplinary approach which may include physician, PT, social work, psychology, etc. (High, Level B)
- May relate to vestibulo-oculomotor dysfunction, which can respond to rehabilitation (Moderate, Level C)
- Sleep disorders and sleep hygiene may also be a factor (Moderate, Level B)

# Quick review:

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A mTBI is:

- A. An alteration in cerebral function caused by force to the head
- B. Loss of consciousness following trauma to the head
- C. Trauma to the head resulting in skull fracture

# History Quiz

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Which of the following is a risk factor for pediatric concussion?

- A. Family history of concussions
- B. Past surgical history of PE tubes
- C. Past medical history of ADHD



# When they don't get better...

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CONSIDER REFERRAL TO APPROPRIATE SPECIALIST  
AND/OR ADDITIONAL ASSESSMENTS IF NOT  
RESPONDING TO TREATMENT AFTER 4-6 WEEKS



# Attention/Memory

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- Make sure sleep is OK
- Make sure other activities aren't preventing good rest/recovery
- Acknowledge any premorbid deficits
- Recognize the impact anxiety/depression has
  - Computer with a bunch of windows open

	Attention	Anxiety
Best evidence	Stimulants	SSRI
Less threatening	Amantadine	Buspirone

# Sleep

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ALWAYS look at sleep hygiene

- Computers/phone off at night
- Consistent bedtime

Isolated trouble sleeping

- Melatonin
- Trazodone

Trouble sleeping plus headaches and/or mood issues

- Elavil (EKG- yes or no); start low, go slow!

Trouble sleeping plus stigmata of sleep apnea

- Consider sleep study or sleep clinic



# Dizziness

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Consider that this may be problems with:

- Attention
- Vision
- Vestibular system

Hydration (may need note for school)

Balance/coordination training (usually sports PT's are better for this)

Vestibular PT

DO NOT send to eye doctor right now. Try PT first.



# Social history

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- ◆ Home
  - Who (custody, supports, stressors)
  - Where (community supports)
- ◆ School
  - Grade level
  - Performance
- ◆ Extracurriculars/Sports/Activities
- ◆ Work
  - Pocket money or family business/needs



# Why are goals so important???



# Family history

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Headaches

Pain disorders

Sleep disorders

Mood disorders

Find out what interventions  
and medications worked...  
and which didn't.

# The most important question

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## Are you back to 100%?

- If not, what percent are you?
- What can we do to get you to 100%?
  - Get rid of headaches, insomnia, etc.
- Ask this question each time (of parent and child)







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